(v 1.0 Oct 2007)
(v 2.0 May 2010)
(v 2.1 May 2013)
(v 2.2 Aug 2019)

Description of the neutron.

The proposal is the following:

The neutron is a "bound unstable" system made by a proton and an electron.

The thesis is that, *in a neutron, the electron orbits the proton in a special orbit at which the centripetal force suffered by the electron is more than twice stronger than the Coulomb force that the electron would suffer if it was at rest relative to the proton and at the same distance*. (See below).

More specifically:

While the Coulomb electric force exerted by a proton on an electron is:

(N-1) $$F_{Pe} = -k_C \frac{e^2}{r^2}$$

with

k_C is the Coulomb constant.
r distance between the electron and the proton.
e electric charge of the proton (the charge of the electron being –e).

(see Note N-a below)

what is now being proposed is that, at the *special orbit* followed by the electron *in a neutron*, the attraction force of the proton on the electron is:

(N-3) $$F_N = -g_N \, k_C \frac{e^2}{r^2} \qquad \text{with} \quad g_N > 2$$

where g_N is a numerical factor bigger than 2. (see below).

As has been explained elsewhere in the "Eve model of the aether", the elementary particles of matter, like for instance the proton, modify (redistribute) the speeds of the aetherinos that collide with them with the consequence that from the particle emerges a specific distribution of aetherinos capable to produce forces on other particles. But the distribution of aetherinos re-emerging from some elementary particles like the proton is not isotropous but depends on the direction, or more precisely, on the angle that such direction makes with some characteristic axis of the proton. The same is true for the electron. (This anisotropy is what can be expected from particles that have intrinsic angular momentum and magnetic momentum. The axial anisotropy of the redistributions is intimately related with the mainstream concept of *spin* and would be caused by some inner structure of these particles that would also be the cause of their intrinsic angular momentum).

As explained with more detail in the paper "Radiation emitted by electrons" (radiations_en.pdf), the anisotropous redistributions of both the proton and the electron are characterized by an *axial-polar symmetry*. The symmetry axis of these redistributions is called in the model "Preferred Redistribution Axis" (PRA).

The strength of the force suffered by a target electron depends on the direction relative to the proton by which emerges the distribution of aetherinos that reaches the electron. It also depends on the orientation of the PRA of the target electron relative to the flow of aetherinos coming from the proton. More precisely, suppose an electron E in presence of a proton P. The direction-dependent redistributions of the proton and the electron postulated by the model (in the paper "Radiation emitted by electrons") predict that the force suffered by the electron *increases* as the angle α_P that the direction PE (Proton-Electron) makes with the PRA of the proton *decreases* and also as the angle α_E that the direction PE makes with the PRA of the electron decreases. In particular, the atraction force between a proton and an electron is maximum when $\alpha_P = \alpha_E = 0$ and minimum when $\alpha_P = \alpha_E = \pi/2$

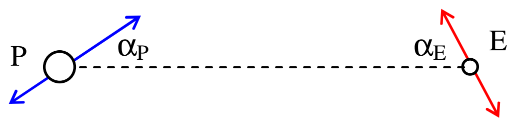

Fig 1

It seems plausible that in a stable orbit of the Hydrogen atom, the electron moves in a trajectory such that at all times the vector PE is perpendicular to the proton's PRA (i.e. the electron orbits the proton's "equator"). Furthermore the electron's PRA is at all times oriented perpendicularly to the vector PE. This continuous "facing each other" of the equatorial directions of the proton and the electron implies that the effective centripetal force suffered by the electron in the Hydrogen atom is weaker than the average force between a randomly aligned proton and a randomly aligned electron. See Fig 1a.

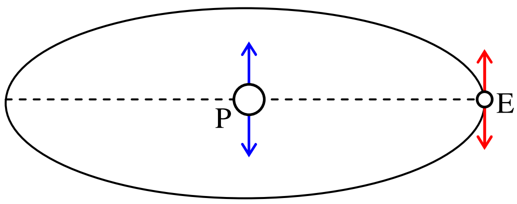

Fig 1a

Fig 1a represents the plausible alignment of the proton's and the electron's redistribution axes in a stable orbit of the Hydrogen atom. These axes remain parallel to each other and orthogonal to the orbital plane.

But, inside the neutron, the model for such special centripetal force (with $g_N > 2$) suffered by the electron would be the following:

In the neutron, the electron is supposed to orbit the proton at a closer distance and faster speed. Due to the close influence of the electron, the proton's PRA would no longer be aligned perpendicularly to the vector PE but would make with it a smaller angle α (see Figs 2a & 2b). This angle α can remain constant at all time if the proton's PRA no longer maintains a fixed orientation in space but follows a precession rotation of the same angular speed to that of the orbital speed of the electron. Furthermore if the electron's PRA remains at all times parallel to the proton's PRA, the ensemble (i.e. the neutron) will create a net redistribution that, when observed from far away, will also show an axial symmetry.
If the proton's redistribution was just the negative of the electron's redistribution, the parallelism of their PRAs would produce a null net redistribution (when observed from far away). But although it seems reasonable to postulate that the *positron*'s redistribution is exactly the negative of the electron's redistribution, other considerations suggest that the *anisotropy* of the *proton*'s redistribution is weaker than that of the electron and therefore the net redistribution of an ensemble of a proton and an electron (with their PRA aligned) will not exactly cancel each other. (In this case the rotation of the net neutron's symmetry axis should give rise to some weak radiation of high frequency).

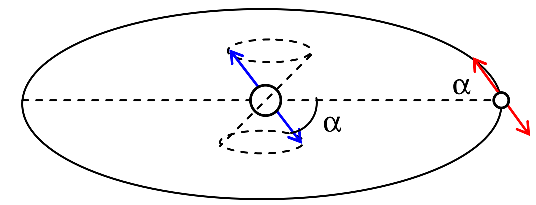

Fig 2a

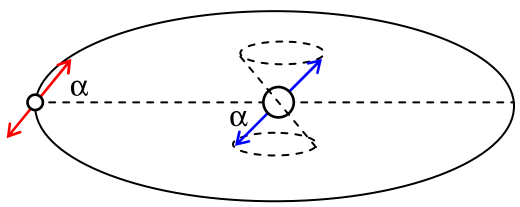

Fig 2b

Figures 2a & 2b represent a neutron with its electron in two opposite positions of its orbit around the proton. The symmetry axes of the proton's redistribution (blue) and of the electron's redistribution (red) remain parallel but are not orthogonal to the orbital plane (i.e. $\alpha \neq \pi/2$). Therefore the electron receives the distribution of aetherinos emerged from a non equatorial direction of the proton. Furthermore, such distribution of aetherinos emerged from the proton arrives to the electron along a non equatorial direction of its PRA. In these circumstances the proton exerts on the electron a stronger force than the one it would exert (at the same distance) if their axes were aligned like in Fig 1a. (The extreme case in which α=0 so that both PRAs lie in the orbital plane and point to each other at all times so the force is maximum seems the most plausible arrangement for the neutron).

Note: It should be interpreted that the mainstream "Coulomb force" (N-1), exerted by a proton *on a static* electron, is the *average* force suffered by a randomly oriented electron in presence of a randomly oriented proton.

If the arrangement in the *Hydrogen atom* is that of Fig 1a, then according to the model the centripetal force exerted by a proton on a stable *orbiting* electron should instead be written as:

(N-4) $$F_H = -g_H \; k_C \frac{e^2}{r^2}$$ where g_H is a numerical constant such that $g_H < 1$

(At the end of the paper "Radiation emitted by electrons", when discussing the electron mass, it is argued that the hypothesis $g_H < 1$ does not imply any contradiction with the known experimental facts).

The force with which the proton attracts the electron is a force subject to statistical fluctuations, like all forces implemented by aetherinos. The forces exerted at very close distances of the particle that originates the force, in this case the proton, are subject to fluctuations of relatively high intensity in comparison with the average value of such force. This is consequence of the fact that when the particle that originates the force (in this case the proton) is affected by a strong fluctuation in the local aether that bathes it, the redistribution being created by the particle has anomalies in the number and the speeds of many of the aetherinos emerging from the proton at that time. And if the electron is very close to the proton, wider is the speed range and hence more are the aetherinos (emerged from the proton during the brief fluctuation) that reach the electron in some given small time interval, due to what, their anomalies (i.e. the anomalies in the number of aetherinos of the different speeds) cooperate to produce in the force suffered by the electron a *stronger* anomaly compared with the average force suffered by the electron at that distance, (it doesn't matter if it is only during a very short time).

In a neutron, the electron has some probability to get free from the proton due to those fluctuations of the aether. When the fluctuation is small the electron will move a small amount away from the centre of the "intense force zone" but will return rapidly to it because the force gradient dictates so. But in some cases the fluctuation will be strong enough to move the electron irreversibly out of its orbit. In the scenario of the special electronic orbit that takes place in the neutron, "moving out of the orbit" means that the electron ceases to have an orbital angular speed equal to the intrinsic angular speed of the proton and therefore ceases to be subject to the intense stable force that characterizes such orbit (passing quickly to suffer a force of intensity similar to the classic Coulomb force that somewhat averages the influence of the aetherinos emerging the proton in the different directions).

As is well known, *for a classic Coulomb orbit*, governed by a centripetal force like (N-1), the potential energy (negative) of the electron is:

$$E_{POT} = -k_C \, e^2 / r$$

while the kinetic energy (positive) has a modulus that is half that of the potential energy and is therefore:

$E_{KIN} = + 1/2\ k_C\ e^2 / r$

as can be deduced equating the centrifugal and the centripetal forces:

(N-6) $m_e\ v^2/r = k_C\ e^2 / r^2 \quad => \quad m_e\ v^2/2 = 1/2\ k_C\ e^2 / r$

Therefore the total energy of the electron is negative and the electron is "bound".

$E_{POT} + E_{KIN} = - 1/2\ k_C\ e^2 / r \quad < 0$

In the neutron, the electron is bound in the sense that it is kept in an orbit close to the proton but its energy balance needs further discussion:

Parking away relativistic considerations, the *kinetic* energy of the electron in its neutronic orbit can be evaluated equating the centrifugal and the centripetal forces and extracting the classic kinetic energy:

$m_e\ v^2/r_N = g_N\ k_C\ e^2 / r_N^2 \quad =>$

(N-8) $E_{KN} = m_e\ v^2/2 = 1/2\ g_N\ k_C\ e^2 / r_N$

But it doesn't seem now licit to suppose that the *potential* energy of the electron is just $– g_N\ k_C\ e^2 / r_N$ but rather the energy (work) that should be applied to move it from its orbital radius r_N to "infinity" with a force that cancels the attracting force of the proton. But the electron, once unrailed from its special neutronic interaction with the proton, is subject to the classic Coulomb force of the proton (to which collaborate aetherinos emerged from all directions of the randomly oriented proton) whose value is $–k_C\ e^2/r_N^2$ (instead of $- g_N\ k_C\ e^2/r_N^2$). Under those circumstances, the work to be done on the electron to move it to infinity opposing such force is:

(N-9) $E_{PN} = – k_C\ e^2 / r_N$

It can therefore be considered that the total energy of the electron in its neutronic orbit is (potential energy + kinetic energy):

(N-10) $E_{TN} = E_{PN} + E_{KN} = - k_C\ e^2 / r_N + 1/2\ g_N\ k_C\ e^2 / r_N$

that for $g_N > 2$ implies $E_{TN} > 0$. This positive net energy of the electron is consistent with the experimental fact that the neutron has a binding energy characterized by an *excess* of mass (instead of the mass defect that is normal in the stable-bound systems), the mass of the neutron being bigger than the sum of the masses of the products of the disintegration (proton + electron).

and therefore *the mass defect of this model of neutron* would be:

(N-11) $\Delta m_N = -\frac{E_{TN}}{c^2} = -(\frac{g_N}{2} - 1)\frac{k_C e^2}{c^2}\frac{1}{r_N}$

But it is also reasonable to expect that the aether fluctuation, that pushes the electron out of its neutronic orbit, steals a small part E_f of the electron's kinetic energy whose exact amount will depend on the features (intensity, etc,...) of such fluctuation. On the whole, the net energy of the electron just derailed from its orbit will be:

$E_{TN} = E_{PN} + (E_{KN} - E_f) = -k_C e^2 / r_N + 1/2\, g_N k_C e^2 / r_N - E_f$

Assuming that $g_N > 2$, the net energy of the derailed electron will be positive as long as the kinetic energy E_f stolen by the fluctuation is small (smaller than some threshold value imposed by g_N). But if its total energy is positive, the electron ceases to be "bound" and it will move indefinitely away from the proton (it will escape) with a speed that will decrease asymptotically towards some limit speed v_L , leaving finally the electron with a zero potential energy (at its "infinite" distance of the proton) and with a remnant kinetic energy $1/2\ m_e v_L^2$

There will be cases in which the fluctuation leaves the electron with insufficient kinetic energy (initial speed) to escape from the proton and there will be some exceptional case in which the fluctuation leaves the electron with "just" the precise kinetic energy to escape so that the electron, as it moves away from the proton, approaches asymptotically a zero speed. In this event the electron will appear after the disintegration with a practically null kinetic energy.

There is therefore no need to postulate the existence of a neutrino to explain the experimental fact that in the disintegration of a neutron, the electron emerges in general with less energy than that corresponding to the mass defect $(m_N - (m_e+m_P))\ c^2$ (where m_N, m_e, m_P are respectively the rest masses of the neutron, electron and proton). What happens is simply that *the energy is not conserved* in these neutron disintegration events because the aether fluctuation steals some energy from the electron and does not return it back to it (being in this respect different from other quantum statistical phenomena in which the fluctuations steal energy in some events but return it in others so that there is a compensation along time).

Note: It is interpreted that energy is not *strictly* conserved in quantum microscopic events. (This is also implicitly assumed in quantum mechanics when it deals for example with quantum tunnelling, vacuum fluctuations, etc,...). Energy should be considered a "statistically conserved magnitude" meaning that it is approximately conserved in macroscopic phenomena that include many microscopic events. The fact that in the disintegration of the neutron there is always a random amount of *missing* energy (never an excess of energy) does not invalidate the assumption that energy is statistically conserved in nature because plausibly the missing energy of these events is basically returned to nature in the inverse processes, creation of neutrons (e.g. in the fusion of Hydrogen atoms in stars).

Another explanation that seems less plausible to the author, is that the missing energy at the disintegration of the neutron is not actually lost but (similarly to what happens in the emission of radiation) the energy is temporarily resident in the aether in the form of some moving disturbance (shock wave?) that can be returned when it encounters matter. It is the arrival of this aether disturbance what would be observing the presumed detectors of neutrinos (Kamiokande, Gran Sasso, etc) although it seems more cautious to think that what those detectors observe are, again, statistical fluctuations of the aether whose origin need not be the beta-decays. In fact the mainstream theory of neutrinos does not seem very convincing since it manifests incapable of deciding about their masses (and hence their speed, according to Relativity) and since it needs to make some grotesque hypothesis (of mysterious mechanisms) like those that assert that during their journey the neutrinos can change their type (electronic, muonic, tauonic).

Relation between the binding energy and the mass defect.

The observed mass of a composite material body whose component particles are *bound* by internal forces (e.g. a nucleus, an atom, a neutron, ...) differs from the sum of the "rest" masses (when at rest and not bound) of its components by an amount called "mass defect".

For example:

A nucleus of Helium-4 is a bound system made by 2 protons and 2 neutrons. Calling m_{He} the mass of the Helium nucleus, m_P the mass of the proton and m_N the mass of the neutron it is observed experimentally that:

$$2\, m_P + 2\, m_N - m_{He} > 0$$

and the positive difference

(N-15) $$\Delta m_{He} = 2\, m_P + 2\, m_N - m_{He}$$

is called "mass defect" of the Helium-4 nucleus.

According to the mainstream interpretation induced by the theory of Relativity, "the energy has mass" ($E = mc^2$) and the mass defect Δm of a bound material system is related with the binding energy E_B of its components by that same relation. i.e.

(N-16) $$\Delta m = - E_B/c^2$$

where the binding energy E_B is equal to *minus the sum of* "the potential energy (negative in general) ascribed to the cohesion forces that keep the system bound" *and* "the kinetic energies of the component particles of the system".

For *example*, in an *atomic nucleus* in which the cohesion forces of the nucleons are the so called "strong force", the potential energy of the system (energy that should be spent to bring apart the nucleons overcoming those strong forces) is negative in sign but of big absolute value. The absolute value of such potential energy is much greater than the sum of the (positive) kinetic energies of the nucleons and therefore, on the whole, the binding energy E_B of an atomic nucleus is positive which would account for the fact that the mass *defect* of the atomic nuclei is also positive. (A positive mass *defect* means that the observed mass of the bound system is smaller than the sum of the masses of its components).

As another *example*, in the *Hydrogen atom* the cohesion force between the proton and the electron is the electromagnetic force. The potential energy of the atom, ascribed to the electromagnetic cohesion of its two components, is the electric potential energy of the electron whose absolute value $k_C\, e^2/r$ is, like it was said above in (N-6), twice the value of the kinetic energy of the electron. (The kinetic energy of the electron amounts to practically all the kinetic energy of the components of the atom because, in the reference frame associated to the centre of mass of the atom, the kinetic energy of the proton is negligible since its mass is much greater than that of the electron). It can therefore be assumed that the binding energy of the Hydrogen atom is:

(N-17) $$E_B = -\,(E_{POT} + E_{KIN}) \;=\; k_C\, e^2 / r - 1/2\, m_e\, v^2 \;=$$

$$= k_C\, e^2 / r - k_C /2\, e^2 / r \;=\; k_C /2\, e^2 / r \;> 0$$

that being positive implies that the mass defect E_B/c^2 of the Hydrogen atom is also positive.

(N-17-b) $$\Delta m_H = \frac{E_B}{c^2} = \frac{k_C\, e^2}{2\, c^2}\,\frac{1}{r}$$

From a phenomenological point of view it is hard to understand that all *energy*, whatever its type, carries a mass associated with it ($E=m\, c^2$). The proposed *Model of the Aether* suggests that, in respect to the internal energy of a system of particles, the following must be interpreted:

It is not strictly the internal *energy* (or the binding *energy*) what increases the mass of the system when the energy is positive or decreases it when it is negative but it is the *speed* v of the component particles that is capable to implement a mass increase and it is the *distance* r of proximity of the particles that is capable to implement a mass decrease of the system.

In what respects the influence of the *speed* of the component particles:

It is well known that according to the theory of Relativity the material particles exhibit a mass that increases with speed. More precisely, the apparent mass m[v] (called relativistic mass) of a material particle of nominal (rest) mass m_0 is:

(N-18) $$m[v] = \frac{m_0}{\sqrt{1 - v^2/c^2}}$$

For example, when a particle initially at rest acquires a speed v it suffers according to (N-18) a mass increase:

(N-19) $$\Delta m = m[v] - m_0 = \frac{m_0}{\sqrt{1 - v^2/c^2}} - m_0$$

but according to the theory of Relativity the kinetic energy of a particle of mass m_0 and speed v is:

$$\text{(N-20)} \qquad K[v] = \frac{m_0 c^2}{\sqrt{1 - v^2/c^2}} - m_0 c^2$$

and therefore Relativity predicts indeed that when a body of mass m_0 is given a kinetic energy K[v] it suffers a mass increase $\Delta m = K[v]/c^2$

For small speeds (v << c) the expression (N-19) can be approximated by:

$$\text{(N-19b)} \qquad \Delta m \cong \frac{1}{2} m_0 \frac{v^2}{c^2} = \frac{E_{KIN}[v]}{c^2}$$

where $E_{KIN}[v] = 1/2\ m_0 v^2$ is the Newtonian kinetic energy (valid for small speeds) of a particle of mass m_0.

NOTE-1: The theory of Relativity, in spite of its correct prediction of this issue, does not penetrate into the nature of mass, leaving the feeling that the mass increase with speed or more generally "the mass-energy equivalence" is still a mystery.

The *EVE Model of the Aether*, though of course not claiming to say the last word, suggests the following explanation of the mass increase with speed:

The *forces* between material particles, and in particular the *force* between electrically charged particles, *depends on the relative velocities* of the particles as follows:

(It is not the magnetic force that is being analysed but a more general feature of forces due to which, for example, the force between 2 charged particles moving face to face along the same straight line does *also* depend on their relative velocities).

Let A be the particle being treated as "origin" of the force and let B be the particle target of the force that is being described. The particle A "originates" the force due to the redistribution of aetherino speeds that it produces. It happens according to the model that the force suffered by B depends on the velocity of B *relative to* A. For example:

- The "frontal" force exerted by an elementary particle A (with electric charge) on an elementary particle B (with electric charge) that moves directly away from A (i.e. along the straight line AB) with a speed u, has been evaluated (according to the general expressions of the force between 2 particles described in the Annex A) for example in the paper http://www.eterinica.net/redistribs_eterinicas_en.pdf and it has been found that a good approximation of such force (for say |u| < c/2) is:

$$\text{(N-21)} \qquad F_{AB}[u] \cong F[0] \left(1 - \frac{u^2}{c^2}\right)^{3/2} \qquad \text{(valid for } |u| < c/2)$$

See for example in the paper redistribs_eterinicas_en.pdf the behaviour of the force $F_{AB}(u)$ for any speed u (and not only for u<c)

Similarly <u>the "abeam" force</u> exerted by a particle A on a particle B of velocity **u** that in the instant of evaluation of the force is perpendicular to the straight line AB, has a strong component along AB (and hence perpendicular to the velocity **u** of B) that can be approximated (for say |u| < c/2) by:

$$\text{(N-21b)} \qquad F_{AB}[u] \cong F[0]\left(1-\frac{u^2}{c^2}\right)^{1/2} \qquad \text{(valid for } |u| < c/2)$$

Acknowledging, as does the model, that an aetherinical force of strength F_{AB} produces on a particle B of mass m_0 an acceleration F_{AB}/m_0, that does not depend on the absolute speed (relative to the aether) of this particle, it is easier to understand why mainstream Physics, *that* does not recognize that the actual forces decrease according to (N-21) or (N-21b), must describe the results of the experiments asserting that the apparent (relativistic) mass of the moving particle increases with its speed.

In the case (N-21b) of a particle B passing abeam a particle A with a velocity **u** perpendicular to AB, the model predicts that the force F_{AB} would produce on the particle B (of mass m_0) an acceleration:

$$\text{(N-22)} \quad a = F_{AB}[u]/m_0 = \frac{F[0]}{m_0}\left(1-\frac{u^2}{c^2}\right)^{1/2} = F[0]/m[u]$$

where the product $m_0\left(1-\frac{u^2}{c^2}\right)^{-1/2}$ has been called m[u] in coincidence with what Special Relativity calls the relativistic mass of B.

Therefore, for the model, ignoring by the time being the potential energy of the composite body, the speed of the component elementary particles of a composite bound system causes that, when an external observer applies an external force F (whose value F has been previously deduced from the theory ($F=m_0$ a) and some experiment that measures the acceleration of a slow particle of known rest mass m_0) to deduce the mass M of the bound system (according to a = F/M) he is actually applying fractional forces f1, f2, f3,... on each of the elementary particles of the system, whose sum (f1+f2+f3+...) is F according to mainstream theory, but according to the model the sum of the real forces acting on each particle is smaller than F (since the component particles are moving relative to the external observer and (N-21b) should be applied). The actual force acting on the composite body being smaller than F causes a global acceleration smaller than F/(m1+m2+m3+) and therefore the mainstream observer will assert that the mass M that he observes (according to M=F/a) is bigger than the sum (m1+m2+m3+...). The positive kinetic energy (i.e. speed) of the component particles does indeed manifests for the mainstream observer as a mass increase confirming his theory that $\Delta m = \Delta E/c^2$

In what respects the influence of the *distance* (between the bound particles).

Strictly speaking, it is *not the* negative *potential energy* the ultimate cause of the mass decrease of a bound system of particles *but the screening* (to the aetherinos that come from outside) that the particles exert on each other due to their proximity. The "sizes" of the particles and the *distances* between them are therefore the fundamental variables that condition and explain the mass defect commonly ascribed to the potential energy. What happens is that the potential energy is directly related to those sizes and distances. This relation is now analysed in the light of some assumptions:

In an aether model of aetherinos it is reasonable to suppose that *the inertial mass* of an elementary particle is proportional to its average cross section to aetherino collisions. Therefore the following hypothesis will be made:

(N-31) $m_P = k_1 \sigma_P$

where m_P is the inertial mass of the particle, σ_P is the net cross section that the particle exhibits to collisions with aetherinos and k_1 a constant.

Actually, in respect to *inertial mass*, the model asserts that when an aetherino collides with an *elementary* particle of cross section σ it gives to the particle an increment of velocity inversely proportional to its cross section σ (i.e. the hypothesis (N-31) has a fundamental significance for elementary particles). When the aetherinos implementing the external force are incident on a *composite* particle, the net force suffered by the particle corresponds to the net number of elementary impulses suffered by its component particles in unit time. Each of the component particles suffers a specific increase of velocity in unit time *proportional to their cross sections* (that also depends on their internal speeds and on the flow of incident aetherinos implementing the external force). The velocity increase of the *global composite* particle in unit time can be defined as the increase (vector) of the *mean position* of its component particles in unit time. And this increase of the mean position in unit time is equal to the average velocity increase suffered by its elementary particles in unit time. Therefore if Newton's second law (F = m a) applies to an elementary particle it also applies to a composite particle and therefore the relation (N-31) does also apply to a composite particle.

In respect to *gravitational mass,* it is reasonable to expect that the bigger the net cross section σ_P (to aetherino collisions) of a material body, the greater will be the redistribution of aetherino speeds of the local aether that it originates, which implies a stronger gravitation field.

Example. Mass defect of the Hydrogen atom.

Let *a* be the "radius" of the proton. The cross section (geometric, in this simplified context) exhibited by the proton to collisions with aetherinos will then be πa^2. (Since a different "radius" can be assigned to the proton in other contexts, perhaps here a more adequate name could be "aether-radius" of the proton).

Similarly, let *b* be the "radius" (aether-radius) of the electron, having therefore a cross section πb^2.

It will also be supposed that the electron is much smaller than the proton, assuming $b \ll a$.

Let r be the *radius of the electron orbit* (around the proton) in the pertinent state of the Hydrogen atom. To simplify it will be considered a circular orbit.

If it is supposed, for description purposes, that both the proton and the electron are spheres of matter opaque to the aetherinos then the *average cross section* of the Hydrogen atom to aetherino collisions can be estimated for example as follows:

Consider the aetherinos that travel towards the atom along a given direction of space. To characterize the direction imagine a point O at an infinite distance of the atom. The pertinent aetherinos, whose screening by the atom wants to be calculated, will then be those travelling along the semi-direction OP that joins the point O with the proton. It could be the case that the atomic electron remains in an orbit whose plane is perpendicular to OP in which case the geometric section of the electron is always entirely contributing to the cross section of the atom. (From a strict point of view, this implies that the mass as has been defined in (N-31) depends on direction). But the particular cases are not of interest here. What is of interest is the *average* section presented by a statistical sample of atoms in which all possible orientations have the same probability. This *average case* can be considered represented by an imaginary atom in which the electron travels, instead of along a circular orbit, along a spherical surface of radius r, having the same probability to be found in any point of the sphere. The distant observer O will then observe that when the electron is in front or behind the proton, so that the straight line OE (O-Electron) intercepts the proton, then the electron does not screen any additional aetherino that the proton wouldn't have intercepted by itself. Since to single out the direction O is placed at an infinite distance, any straight line OE can be considered parallel to OP and therefore, in the sphere of radius r being travelled by the electron there are only two zones of areas approximately equal to πa^2 (the area projected by the proton in a sphere of radius $r \gg a$) in which the electron does *not* contribute to the cross section of the atom.

For the purpose of evaluating the mass defect of the atom in a state in which the electron is supposed to travel a circular orbit of radius r, it can therefore be considered that the proton (assumed to be much bigger than the electron, i.e. $a \gg b$) does *not* contribute to the mass *defect,* since a cross section πa^2 is always entirely contributing to the atom's mass, while the electron exhibits its cross section πb^2 only during the fraction of time at which it is neither in front nor behind the proton for the distant observer O.

Since the spherical surface "travelled" by the electron in such "average atom" has an area $4\pi r^2$, that means that the electron *does not* contribute to the cross section of the atom during a time fraction approximately equal to $2(\pi a^2)/(4\pi r^2)$ and therefore *the time fraction during which it does contribute is*:

(N-32) $$f_D = 1 - \frac{2\pi a^2}{4\pi r^2} = 1 - \frac{a^2}{2r^2}$$ (approximation for $r \gg a$)

Hence, since the so called "mass of the electron" (the one it would have at rest, averaged for all directions of space, and with no other material body screening it from the surrounding aether) is according to the hypothesis (N-31) equal to $k_1 \pi b^2$, then *the mass defect of the electron due to its proximity to the proton* would be:

(N-33) $$\Delta m_e[r] = m_e - m_e\ f_D\ =\ m_e\ \frac{a^2}{2r^2}$$

because the "mass defect" of one particle can somehow be defined as:

nominal mass (when isolated and at rest) - effective mass (in a specific scenario).

But such $\Delta m_e[r]$ would correspond *only* to the mass defect *due to screening* but otherwise it assumes that the electron is at rest and therefore does not include the correction due to *speed* mentioned above.

In what refers to the contribution of the *speed* to the electron's mass defect" (actually here a *negative* mass defect or mass increase with speed), it is guessed that the expression (N-22) represents adequately the centripetal acceleration suffered by an orbiting electron of speed. Therefore, the model could also "invoke" (clumsily) that the average effective mass of the electron when in a state (orbit) of speed v is:

(N-22-b) $$m[v] = m_e\left(1-\frac{v^2}{c^2}\right)^{-1/2}$$ valid for $v < c/2$

where m_e is the nominal mass (called "rest mass" in Relativity) of the electron.

the mass defect of the electron *due only to its speed* (if it suffered no screening by the proton) is:

(N-35) $$\Delta m[v]\ =\ m_e\ -\ m_e\left(1-\frac{v^2}{c^2}\right)^{-1/2}$$

Combining both effects:

- accounting for the fraction f_D of time during which the electron is unscreened (given in (N-32)), the apparent or "effective" (corrected by screening) mass of the electron (in the H atom) will be $m_e\ f_D$

- and now applying to such "corrected by screening mass" the apparent increase of mass due to speed, the global apparent mass of the electron in the atom will be

$$m_e\ f_D\left(1-\frac{v^2}{c^2}\right)^{-1/2}$$

that subtracted from the rest mass m_e of the electron gives the *overall mass defect* Δm_e of the electron in the H atom (that in this case can also be considered the mass defect of the Hydrogen atom):

$$\text{(N-36)} \qquad \Delta m_e = m_e - f_D\, m_e \left(1 - \frac{v^2}{c^2}\right)^{-1/2} =$$

$$= m_e - \left(1 - \frac{a^2}{2r^2}\right) m_e \left(1 - \frac{v^2}{c^2}\right)^{-1/2}$$

that, as said, is an *average* mass defect (the one measured in normal experiments).

Considering now that, according to the classical mechanics description of an Hydrogen atom the orbital speed and the orbital radius of the electron are related (equating the Newtonian centrifugal force to the Coulomb centripetal force) by:

(N-6) $\qquad m_e\, v^2 / r = k_C\, e^2 / r^2 \qquad \Rightarrow \qquad v^2 = k_C\, e^2 / (m_e\, r)$

that replaced in (N-36) leads to the following expression for the overall *mass defect of the Hydrogen atom* as a function of the orbital radius of the electron:

$$\text{(N-37)} \qquad \Delta m_e = m_e \left(1 - \frac{\left(1 - \frac{a^2}{2r^2}\right)}{\sqrt{1 - \frac{k_C\, e^2}{m_e\, r\, c^2}}} \right)$$

But it is easy to check that the expression N-36 (and hence N-37) for the mass defect of the Hydrogen atom *is wrong* since for all reasonable values of the proton radius *"a"* (being $a << r$) and all reasonable values of v (being $v << c$) it predicts a negative mass defect, while the (non suspicious) mainstream expression of the mass defect E_B / c^2 of the Hydrogen is always positive since the binding energy E_B of such atom is given by (see above):

(N-17) $\qquad E_B = -\,(E_{POT} + E_{KIN}) = k_C/2 \;\, e^2 / r$

It is believed that the proposed interpretation of the mass defect, although it plausibly sheds some light on the phenomenology involved, does not yet adequately evaluate the shielding of the electron by the proton in what concerns the mass of the atom. To allow for a good "qualitative" fit between with the binding energy (N-17) of the Hydrogen atom, the time fraction f_D during which the electron's mass is visible, given at (N-32), should be replaced by the following ad hoc expression:

(N-32-b) $\qquad f_D = 1 - k_2 \dfrac{a}{r} \qquad$ (approximation for $r >> a$)

that implies an overall mass defect of the hydrogen atom given now by:

(N-36-b)
$$\Delta m_e = m_e - f_D\, m_e \left(1 - \frac{v^2}{c^2}\right)^{-1/2} = $$
$$= m_e - (1 - k_2 \frac{a}{r})\; m_e \left(1 - \frac{v^2}{c^2}\right)^{-1/2}$$

where:

m_e is the mass of the electron
a "radius" of the proton
r radius of the orbit of the electron
v speed of the electron in its orbit
c speed of light
k_2 a non dimensional constant

Considering now that, according to the classical mechanics description of an Hydrogen atom the orbital speed and the radius of the electron are related (equating the Newtonian centrifugal force to the Coulomb centripetal force) by:

(N-6) $m_e\, v^2 / r = k_C\, e^2 / r^2 \quad \Rightarrow \quad v^2 = k_C\, e^2 / (m_e\, r)$

that replaced in (N-36-b) leads to the following expression for the overall *mass defect of the Hydrogen atom*:

(N-38)
$$\Delta m_e = m_e \left(1 - \frac{(r - k_2\, a)}{r \sqrt{1 - \frac{k_C\, e^2}{m_e\, r\, c^2}}} \right)$$

that decays with the orbital radius r in the same "qualitative" way as the classical expression (N-17-b) $\Delta m_H = \frac{E_B}{c^2} = \frac{k_C\, e^2}{2 c^2} \frac{1}{r}$ described above

and where:

k_2 is a non dimensional constant
e the elementary electric charge (that of the proton)
k_C Coulomb's constant

Furthermore, it has been found (with guess and trial) that if the constant k_2 is supposed (ad hoc) to have the following dependence on other constants:

(N-39) $$k_2 = \frac{k_C\, e^2}{a\, m_e\, c^2}$$

then the mass defect of the model (for the H atom) (N-38) behaves not only qualitatively but also *quantitatively the same* as the mainstream mass defect expression (N-17-b) $\Delta m_H = \frac{E_B}{c^2} = \frac{k_C e^2}{2c^2} \frac{1}{r}$ described above. (It can also be checked that the constant k_2 of (N-39) is a non dimensional constant)

Binding energy of the neutron.

Let r_N be the orbital radius of the electron in the special *neutronic orbit* (for which, as said above, the proton has an intrinsic angular speed that equals the orbital speed of the electron).
If instead of the "neutronic" orbit, the orbit of radius r_N were a "standard" (Coulomb-type) orbit (in which the electron suffers a centripetal force corresponding to an averaged aetherinical field of the proton instead of being anchored in front of the intense zone) then the classic kinetic energy ($1/2\, m_e v^2$) of such orbiting electron would be according to (N-6):

(N-44) $$1/2\, m_e v^2 = k_C e^2 / (2\, r_N)$$

But if the orbit of radius r_N is the neutronic orbit, the kinetic energy of the electron is g_N times the former because, as was said above in (N-3), in the neutronic orbit the electron suffers a centripetal force:

(N-3-b) $$F_N = -g_N\, k_C \frac{e^2}{r_N{}^2} \qquad \text{(with } g_N > 2)$$

that equating, the centrifugal and the centripetal forces, now predicts

(N-45) $$1/2\, m_e v_N{}^2 = g_N\, k_C\, e^2 / (2\, r_N)$$

Hence, in a *neutronic* orbit of radius r_N the electron has g_N times more kinetic energy than it would have if the orbit of radius r_N was not neutronic but governed by the standard (averaged) centripetal force of the proton on a randomly oriented electron.

On the other hand, as defended above, the potential energy of the electron in the neutronic orbit of radius r_N is given
(see (N-9)) by $E_{PN} = -\, k_C\, e^2 / r_N$ (and not by $-\, g_N\, k_C\, e^2 / r_N$)

In what respects *the mass defect* of the neutron, the reasoning applied to the Hydrogen atom is valid here. The mass defect of the neutron predicted by the model can be obtained following the same steps that were done above to calculate that of the Hydrogen atom (mass decrease due to the screening of the electron by the proton corrected by a mass increase due to the speed of the electron), leading again to the expression (N-36-b) that will here be rewritten with the sub index "N" in the speed and the radius as:

(N-36-b) $$\Delta m_{eN} = m_e - (1 - k_2 \frac{a}{r_N})\; m_e \left(1 - \frac{v_N{}^2}{c^2}\right)^{-1/2}$$

but according to (N-45), in the neutron, the relation between the orbital speed v_N of the electron and the radius r_N of its neutronic orbit is now:

$$(\text{N-37-b}) \qquad v_N^{\,2} = g_N \frac{k_C\, e^2}{m_e\, r_N}$$

that leads to the following expression for *the mass defect for the neutron*:

$$(\text{N-46}) \qquad \Delta m_{eN} = m_e \left(1 - \frac{(r_N - k_2\, a)}{r_N \sqrt{1 - \dfrac{g_N\ k_C\, e^2}{m_e\, r_N\ c^2}}} \right)$$

that corresponds simply to (N-38) where the constant k_C has been replaced by $g_N\, k_C$.

It can be seen that assigning the constants {m_e, e, c, k_2, k_C, *a*} the same values of the above example and taking $g_N > 2$, the prediction is that (independently of the orbital radius r_N as long that $r_N > a$) the expression (N-46) gives a *negative* mass defect for the neutron which is consistent with the experimental fact that the mass of the neutron is bigger that the sum of the masses of a proton and an electron.
And again, it can be seen that if the constant k_2 has the dependence on other constants $k_2 = \dfrac{k_C\, e^2}{a\, m_e\, c^2}$ (proposed above in N-39 for the H atom) then the mass defect of the model (for the Neutron, N-46) behaves not only qualitatively but also *quantitatively the same* as the mass defect expression (N-11) $\Delta m_N = -(\dfrac{g_N}{2} - 1)\dfrac{k_C\, e^2}{c^2}\dfrac{1}{r_N}$ described above.

Foot Notes:

N-a: According to the model (see for example the paper Redistribution of aetherino speeds), the centripetal force (*corrected by the speed of the electron relative to the proton*) that the proton exerts on an electron of orbital speed v is:

$$(\text{N-2}) \qquad F_{Pe} = F_{Pe}[0] \left(1 - \frac{v^2}{c^2} \right)^{1/2} = -k_C \frac{e^2}{r^2} \left(1 - \frac{v^2}{c^2} \right)^{1/2} \qquad (\text{valid for } v << c)$$

Since the correction (N-2) does not affect significantly the introductory description it will not be considered here but only below when dealing with the "mass defect" (see Eq[N-21b] of this paper).